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Tussock moth and several other less known species. They are pure white with a silky lustre and a reddish-brown tuft at the end of the abdomen from which arises the common name. The young larva pass the winter in a nest made by drawing together a few terminal leaves of a twig and lining and surrounding them with a mass of silken threads. It is not known exactly when or how it was introduced into America but it has been noticeably injurious for at least four years and it is possible that it may have been imported with some foreign stock. It is at present confined to a small area in the vicinity of Boston.—W. F. F.

EMBRYOLOGY.[1]

Spinning in Serpula Eggs.—In a paper[2] published in the Journal of Morphology, G. F. Andrews described remarkable and hitherto unrecorded phenomena in the eggs and larvæ of star-fish and sea-urchins and designated them filose protoplastic or "spinning" activities.

These "spinning" phenomena may be described as the formation of filaments extending out from the surface of the egg or cell and either straight, curved or bent; either separate or united to others; either simple or variously branched; attached at the base, and either free at the tip or attached there also—to the egg membrane, to other filaments or to the surface of some other cell. What makes these threads recognizable as living protoplasm is chiefly the character of their activities. They are *spun* out from the living egg or cell as are the filose pseudopodia of such creatures as Gromia, or as some of the pseudopodia of the leucocytes of certain Invertebrates. The processes are seen to grow longer or shorter, to branch, to join onto and fuse with others; they grow thicker or thinner, and often show nodular enlargements that pass along as in currents of living protoplasm.

Such filose spinnings connect the egg with its membrane, the cleaving cells with one another, and the polar bodies with adjacent cells or with the unsegmented egg. They traverse the cleavage cavity and put cells of ectoderm, entoderm and mesoderm into communication with cells of the same and of other germ layers.

Such intercellular connections are temporary, made and remade; they spin out as a cell is separating from its fellow in division and are not seen when the cells are closely pressed together.

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[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] See the AMERICAN NATURALIST. No. 363, March, 1897, page 242.

Having been shown these phenomena both in living and in preserved echinoderm eggs I was able to find them again in the common Annelid, Serpula;—though as yet by no means as clearly and extensively as in the more thoroughly studied and favorable star-fish material.

The egg of Serpula is much less favorable than that of the star-fish, as far as the seeing of spinning phenomena is concerned, since it has a thick, very highly refracting membrane that makes it difficult to see fine structures within it, and since also the cells are so closely crowded together and against the membrane (which remains as the larval cuticle) that there are few free spaces which could be traversed by spin threads.

Yet some filaments can be seen passing out from the egg, or cells, to the membrane. As yet I have not seen spinning filaments connect one cell with another though there was evidence that such probably exist and are to be seen with good light and favorable point of view.

When the polar bodies have been formed, the membrane is raised up from the egg sufficiently to leave a space all about the polar bodies. Though at first no processes are seen, they gradually form and extend out from the egg till they cross the space and become attached to the membrane. These processes are unmistakably the same as the spinnings of the star-fish egg. They are of different lengths and thicknesses and arise from the surface of the egg all around the polar bodies. The polar bodies were not seen to spin.

In cases where the egg-membrane is raised up locally at the end opposite to the polar bodies, spin-threads were also seen passing from this side of the egg to the raised membrane.

In abnormal individuals where the membrane is widely separated from the egg, long and very numerous and distinct threads were seen radiating out from the entire surface of the egg to the membrane. As in the star-fish there is a marked difference between the spinning of normal and abnormal eggs.

When the egg has divided into two cells and these are rounding off at the edges preparatory to the next division, spin processes are seen passing off from each cell to the membrane, both at the polar body pole and at the opposite end.

Here I first observed the branching of filaments, so characteristic in the star-fish. One common trunk arising from a cell presents a number of long branches that pass in various planes out to the membrane.

In later stages when eight or more cells are present, processes were seen, both in profile and in surface view, passing out from various cells to the membrane.

In the gastrula stage when the equatorial band of cilia is formed and the cleavage cavity nearly closed up by the elongated entoderm cells, spin processes were seen at the end opposite to the area of invagination, passing from the ectoderm cells to the membrane where it was slightly raised away from the ectoderm. Here also some movement and change of form was seen in a process, though not satisfactorily. Within the cleavage cavity a moving, pseudopodium-like process appeared to extend out from the entoderm toward the ectoderm, but it could not be seen clearly.

Some of these processes in Serpula, less difficult to see than the finest, presented enlargements, suggesting the probability of slow flowing of material along the process. The increase in number and length of filaments from a definite area under observation for a few minutes showed that they were gradually formed, and from the egg outwards.

Owing to poor light no higher than 8 eye-piece could be used with 2 mm. objective, so that it is probable many phenomena escaped observation.

The occurrence of such filose activity of the surface of the eggs of an animal so widely separated from the echinoderms supports the idea that such phenomena are universally properties of protoplasm,—an hypothesis put forth in a recent work[3] and based not only upon egg, and other, external spinnings, but upon numerous internal protoplasmic phenomena of the same nature, such as spinnings into alveoli of Bütschli's structure in both fluid areas and contractile structures, and contraction and strial displacements of the substance.

E. A. ANDREWS.

PSYCHOLOGY.[1]

Some Experiments on the Tactual Threshold for the Perception of Two Points.[2]—The term "space-threshold" was applied by Fechner to the distance which two small points must be apart in order to be perceived as two. Weber had already devoted

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[3] The Living Substance as Such and as Organism. G. F. Andrews. Gnin & Co. Boston. August, 1897.

[1] Edited by Howard C. Warren, Princeton University, Princeton, N. J.

[2] The first group of experiments described here were reported in the *Philosophische Studien*, 1897, XIII, 163–222, reprinted in *Princeton Contributions to Psychology*, II, 1–60. The second group, viz., those with successive stimuli, will appear in an early number of the *Psychological Review*.